

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Gender and ethnic differences in publication of BMJ letters to the editor: an observational study using machine learning
AUTHORS	Zeina, Mohamad; Balston, Alfred; Banerjee, Amitava; Woolf, Katherine

VERSION 1 – REVIEW

REVIEWER	Karin Amrein Medical University of Graz
REVIEW RETURNED	12-Mar-2020

GENERAL COMMENTS	<p>The authors have well responded to all raised topics and clarified them.</p> <p>The paper reads now very well and covers an important topic.</p> <p>COMMENT TO THE BMJ: is there any formal process how it is decided which letters are published?</p>
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REVIEWER	Gabrielle Ramirez University of Pennsylvania, United States of America
REVIEW RETURNED	12-Mar-2020

GENERAL COMMENTS	<p>Thank you for writing this timely piece and taking the time to consider my previous recommendations. This revision was much easier to read, and I only have a few clarifying suggestions, as well as thoughts on future research.</p> <p>It is interesting to see the use of machine learning in an analysis like this. I think the authors' research highlights the efficiency of the technology. Therefore, I would hope that they explicitly state the accuracy rates of nameprism.com and Gender Guesser in their introduction. Those who read their paper may feel inspired to apply machine learning to their own works.</p> <p>My next suggestion is to combine tables 1 and 2. At a minimum, the p-values should be included in table 1. Additionally, dependent on time, it may be more useful to see a table comparing the other identifiers (e.g. author position, twitter handle) between genders or ethnicities. Even if the comparisons are not statistically significant, the presentation of a table would dismiss any speculation.</p> <p>In their discussion, I recommend that the authors replace the word "weaknesses" with "limitations." Additionally, it would be nice to separate the strengths and weaknesses of the study into two parts. Lastly, the information under "Strengths and weaknesses in</p>
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	<p>relation to other studies" should fall under the introduction because it gives the reader a good idea of the current state of the field.</p> <p>Furthermore, the authors should rename "meaning of the study: possible mechanisms and implications" to either "potential implications" or simply "implications." I agree that implicit bias is a potential explanation for the underrepresentation of women and non-White authors. I strongly think they should also talk about the implications of machine learning. Although it was not the focus of the paper, I believe the authors' results are strong and unique because they were acquired using this technology. This is especially apparent when juxtaposed to the manually completed Science report they cited.</p> <p>Finally, I think the authors can include additional routes for future research. For instance, it would be interesting to see the rates of publishing over time. Society has changed a lot since 1998 and it would be comforting to know that rates are becoming more equal. Another idea is to compare the topics submitted. I know the authors acknowledged that the field of work has been dismissed as a factor for unequal pay between women and men. However, there was no similar comparison made in publishing. Although not in complete alignment, another research pursuit could include comparing the nationalities or locations of home institutions of submitted pieces. In the future, I hope the authors will have the chance to perform an experiment to confirm a causal relationship. Until then, I believe that this paper opens a much-needed conversation in academia.</p>
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REVIEWER	Mark Bolland University of Auckland, New Zealand
REVIEW RETURNED	29-May-2020

GENERAL COMMENTS	<p>I am uncertain why I have been invited to review this paper. It already has had 4 reviews, and I think it is unfair both on the authors and any new reviewers to go through another round of reviews.</p> <p>For what it is worth, I agree with the previous Reviewers' concerns and am skeptical about the accuracy and validity of the approach of estimating gender and ethnicity by name.</p> <ol style="list-style-type: none"> 1. In the paper, it is not clear to me what happened if authors only used first initials. Perhaps that accounts for the large number of unknowns in the gender analysis. There is no similar amount for the ethnicity analysis, so perhaps the ethnicity analysis just proceeded by the last name only. 2. There will be a lot of misclassification: for example the surname Young is a fairly common surname for people of Asian descent, but will be classified as White in this analysis. 3. Ethnicity is a social construct, so for a person with say an "Asian" name whose family has lived in the UK/US for many generations, should they be categorized as Asian, even if they themselves don't identify as such? The concern about married women taking their husbands surname and misidentify their ethnicity has already been made without being addressed.
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	<p>4. The gender guessing component is poorly described with no independent validation of its predictive performance. The only link is to the python code (ref 21). The cited reference in the Discussion (#33) doesn't appear to be for the same tool. For the gender guesser tool, there is an option for adding country to give more specific answers, it is not clear whether the authors used this option, or how it would impact on their results. Country is available for rapid responses.</p> <p>Eg from the python site: <pre>>>> print(d.get_gender(u"Jamie")) mostly_female >>> print(d.get_gender(u"Jamie", u'great_britain')) mostly_male</pre></p> <p>5. Given the worldwide readership of the BMJ, and presumably submission of rapid responses to the journal, I'm extremely skeptical that ethnicity estimations based on names are valid. In my view, large amounts of potential misclassifications make the data unreliable, and therefore, unfortunately, conclusions based on the data are also unreliable, even though the topic itself is worthy of study and the conclusions themselves may actually be correct.</p> <p>6. I can't see any way of appeasing the concerns raised without checking a randomly selected subset of the authors and confirming with the author their gender and ethnicity, as one of the Reviewers already suggested. It might or might not be laborious depending on what information the authors extracted from the BMJ website. Email addresses will be available from the published letters to the editor, either on the BMJ, or through Pubmed or some other database, so it should be a relatively straightforward exercise to automatically extract the emails and then contact the authors asking them whether the programs had estimated their gender and ethnicity correct. This will be a time-consuming process and might require ethical review, but is the only way I can see to ensure the data are actually valid.</p>
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REVIEWER	Aamir Raoof Memon Peoples University of Medical & Health Sciences for Women, Nawabshah (SBA), Sindh, Pakistan
REVIEW RETURNED	22-Jun-2020

GENERAL COMMENTS	<p>The authors have presented an extensive and well-written analysis of the influence of the gender and ethnicity on publication of the rapid responses in the BMJ. The methodology robust and well-explained. I have the following suggestions for improvement:</p> <p>I wouldn't appreciate the use of the term "black" for an ethnic group. In my humble opinion, this is a racially offensive term and should not be used, please consider using "African-American" instead. Please change this throughout the manuscript</p> <p>Please mention the number of the responses (<2%) that could not be collected automatically due to errors in their formatting.</p> <p>What is the validity of the textstat and language-check tool?</p> <p>Name-prism also gives information about the nationality of the author, why was not this considered?</p> <p>It would better not to start a sentence with a digit. Please check and correct on line # 49 of page # 7</p> <p>The abbreviations should be spelled out at the bottom of the table. Any additional notes should also be placed at the bottom of the table.</p>
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	<p>The findings of the univariate analysis should appear in the table as well.</p> <p>I wonder why authors have not included findings of both the blocks in the table. I would appreciate if this is done.</p> <p>Twitter account was taken as a variable. Twitter was founded in 2006, so authors publishing rapid responses after this time might have been included.</p> <p>Page 10 line 43: "in the UK" should be changed to "outside the US" as the reference made should not be limited to 2.</p> <p>Page 10 line 52: "true data" or "truth data"?</p> <p>The discussion needs some re-structuring. The strengths and limitations should come at the end of it. This section should rather begin with "Meaning of the study".</p> <p>Conclusion section should be added at the end.</p> <p>References should be according to the journal's style.</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

The authors have well responded to all raised topics and clarified them.
The paper reads now very well and covers an important topic.

Thank you very much for your kind words. We are glad that you feel we have responded to and clarified all points. We are happy that you agree this is an important topic.

Reviewer: 2

Thank you for writing this timely piece and taking the time to consider my previous recommendations. This revision was much easier to read, and I only have a few clarifying suggestions, as well as thoughts on future research.

We are glad you agree that our revision is "timely" and "much easier to read". Thank you for submitting further clarifications and thoughts.

It is interesting to see the use of machine learning in an analysis like this. I think the authors' research highlights the efficiency of the technology. Therefore, I would hope that they explicitly state the accuracy rates of nameprism.com and Gender Guesser in their introduction. Those who read their paper may feel inspired to apply machine learning to their own works.

We are glad you feel this work may inspire others to consider machine learning methods. We have added the model performance for nameprism.com in the methods section. As the Gender Guesser documentation does not state an accuracy we performed our own validation of this tool and have included this in our paper in the methods section.

My next suggestion is to combine tables 1 and 2. At a minimum, the p-values should be included in table 1. Additionally, dependent on time, it may be more useful to see a table comparing the other identifiers (e.g. author position, twitter handle) between genders or ethnicities. Even if the comparisons are not statistically significant, the presentation of a table would dismiss any speculation.

Thank you for comments and suggestions. We have added p-values to the baseline characteristics table (table 1) as you have suggested. We feel that keeping the baseline characteristics and multivariate analyses in two separate tables (that is, table 1 and 2 respectively) is easier to understand for readers.

We have created two new tables to compare characteristics between genders and ethnicities as you suggested, and included these as supplemental figures.

In their discussion, I recommend that the authors replace the word “weaknesses” with “limitations.” Additionally, it would be nice to separate the strengths and weaknesses of the study into two parts. Lastly, the information under “Strengths and weaknesses in relation to other studies” should fall under the introduction because it gives the reader a good idea of the current state of the field.

Furthermore, the authors should rename “meaning of the study: possible mechanisms and implications” to either “potential implications” or simply “implications.” I agree that implicit bias is a potential explanation for the underrepresentation of women and non-White authors.

We have changed the word “weaknessess” to “limitations” and renamed the section “meaning of the study: possible mechanisms and implications” to “implications” as you have suggested. However, we believe the introduction already provides a good overview of the field, and the specific points we mention in “strengths and weaknesses in relation to other studies” are better discussed in the context of our own findings in the discussion. And regarding separating the strengths and limitations, we think this is difficult because many of the points we make in that section are very nuanced, and one point may have advantages and disadvantages. Therefore we think it is best to discuss them together.

I strongly think they should also talk about the implications of machine learning. Although it was not the focus of the paper, I believe the authors’ results are strong and unique because they were acquired using this technology. This is especially apparent when juxtaposed to the manually completed Science report they cited.

Thank you for describing our results as “strong and unique”. We have added more on the implications of machine learning.

Finally, I think the authors can include additional routes for future research. For instance, it would be interesting to see the rates of publishing over time. Society has changed a lot since 1998 and it would be comforting to know that rates are becoming more equal. Another idea is to compare the topics submitted. I know the authors acknowledged that the field of work has been dismissed as a factor for unequal pay between women and men. However, there was no similar comparison made in publishing. Although not in complete alignment, another research pursuit could include comparing the nationalities or locations of home institutions of submitted pieces. In the future, I hope the authors will have the chance to perform an experiment to confirm a causal relationship. Until then, I believe that this paper opens a much-needed conversation in academia.

These are all valid and very interesting avenues for future research, which we have added to our manuscript. Thank you for agreeing that this paper “opens a much-needed conversation”.

Reviewer: 3

I am uncertain why I have been invited to review this paper. It already has had 4 reviews, and I think it is unfair both on the authors and any new reviewers to go through another round of reviews.

For what it is worth, I agree with the previous Reviewers’ concerns and am skeptical about the accuracy and validity of the approach of estimating gender and ethnicity by name.

This point, which is a very important one, is repeated throughout the response, and so we will address it broadly here first. We will elaborate on specific points below the specific points they relate to later.

- Ethnicity is not, as you presume below, estimated from surname only. This uses first and surname for significantly improved accuracy. We will update the manuscript to make this clearer.
- We have conducted our own independent validation of the gender inference tool used, which finds it to be 98.4% accurate at detecting "male" vs "female". We elaborate on this below, and have included this in the manuscript.
- There will be inaccuracy regardless of the technique used, and there is no gold standard. Genetic measures of ethnicity often disagree with self identified ethnicity, with for example some self identified African-Americans displaying 99% European "genetic ancestry" (<https://humgenomics.biomedcentral.com/articles/10.1186/s40246-014-0023-x>). In the children of mixed race couples, there may be significant mismatch between self identified ethnicity and perceived ethnicity, and these may even change over time and depending on context.
- In the small percentage of names which are misclassified, a reader will often agree with the automatically inferred gender or ethnicity (whether consciously or unconsciously). As stated in the nameprism paper, "our results will generally agree with the reader's judgement". Thus, even when a name is misclassified, this inferred class acts as a useful marker of "perceived" ethnicity or gender.
- This perceived ethnicity or gender is what would mediate an implicit bias if there is one, and so a difference between someone's self identified group and their perceived one is not an inaccuracy. A bias based on names alone has been demonstrated in research that shows identical applications for a laboratory manager position were deemed better if the application was from a male name compared to a female name (<http://www.ncbi.nlm.nih.gov/pubmed/22988126>). The same effect is seen between races – a study that sent resumes that were identical apart from having a typically white or black name assigned to it found applicants with typically white names were 50% more likely to have a callback (https://scholar.harvard.edu/files/sendhil/files/are_emily_and_greg_more_employable_than_lakisha_and_jamal.pdf).
- Inaccuracy in estimation of gender and ethnicity underestimates the true effect size of our findings, and the less accurate you believe the classification to be, the greater you believe this underestimation is. For example, imagine a very poor estimator which estimates ethnicity by pure chance. Thus, William has equal probability of being estimated as "White" as it does "Hispanic" or "Black" for example. A study based on such a classifier, on average, will find no difference in the publication rates between these ethnicities.
- Automated techniques are the only way to conduct a study of this size, and will become increasingly important as large datasets such as this become more accessible.

1. In the paper, it is not clear to me what happened if authors only used first initials. Perhaps that accounts for the large number of unknowns in the gender analysis. There is no similar amount for the ethnicity analysis, so perhaps the ethnicity analysis just proceeded by the last name only.

The gender analysis proceeded with first name only, with no special treatment for authors who only gave a first initial. Thus, you are correct and they would be classed as "unknown" gender because there are no single letter names in the name dictionary we used for this analysis.

The ethnicity analysis used first and last name together for improve accuracy. The reason there was no "unknown" ethnicity is because of the different methodology used in this tool. This does not use a dictionary of names, but instead uses machine learning to find patterns of letters which are indicative of different ethnicities. Therefore it can infer ethnicity from these patterns, even for names it hasn't seen before.

2. There will be a lot of misclassification: for example the surname Young is a fairly common surname for people of Asian descent, but will be classified as White in this analysis.

The nameprism.com tool looks at first and last name together exactly for this reason. The surname "Young" demonstrates the point well. "John Young" is classified as "White" while "Qiang Young" is classified as "Asian and Pacific Islander".

3. Ethnicity is a social construct, so for a person with say an "Asian" name whose family has lived in the UK/US for many generations, should they be categorized as Asian, even if they themselves don't identify as such? The concern about married women taking their husbands surname and misidentify their ethnicity has already been made without being addressed.

It is the perceived ethnicity, and not the self identified ethnicity, that mediates any unconscious biases. When either of the people in your examples submit works to scientific journals who have access to their names, anyone reviewing this work may be subconsciously influenced by this name, and not by the self identified ethnicity.

It is also worth noting that mixed ethnicity couples, such as in your second example, affect any classification system, because this couple's children may have inconsistent perceived or self identified ethnicity.

4. The gender guessing component is poorly described with no independent validation of its predictive performance. The only link is to the python code (ref 21). The cited reference in the Discussion (#33) doesn't appear to be for the same tool.

The cited reference (#33) was intended to demonstrate the validity of dictionary-based gender estimating tools, not "gender guesser" in particular. We apologise for the miscommunication, and have clarified this in the final manuscript to make this clearer.

You are correct that we did not originally reference any independent validation of this specific implementation, "gender guesser". Thus, we have included one, and also carried out our own. On a public dataset of 29,872 names extracted from Wikipedia, the tool was able to infer gender for 82.76%. The names inferred as "male" were 99.2% accurate, and those inferred as "female" were 95.6% accurate. This is favourable to the tool cited in #33 above, both in the proportion of names it is able to infer gender from, as well as the accuracy when it does infer a gender.

For the gender guesser tool, there is an option for adding country to give more specific answers, it is not clear whether the authors used this option, or how it would impact on their results. Country is available for rapid responses.

Eg from the python site:

```
>>> print(d.get_gender(u"Jamie"))
mostly_female
>>> print(d.get_gender(u"Jamie", u'great_britain'))
mostly_male
```

We did not use the option in "gender guesser" for specifying country. Though authors specify an institutional address, this data is extremely heterogeneous making it impractical to extract automatically. For example, many authors do not specify country, but a city or institution name. Even those who specify the country do so inconsistently, for example sometimes using abbreviations and sometimes not. There is also the complexity of picking the correct location when multiple authors

provide addresses.

Additionally, from a quick analysis we ran since reading your comment, it seems only a very small minority of names would be estimated differently depending on country. Of the 45,376 names in the dictionary used by "gender guesser", only 679 (1.5%) are influenced at all by location, and less than that, 286 (0.6%) might have the gender estimation changed from "male" to "female" or vice versa based on location.

5. Given the worldwide readership of the BMJ, and presumably submission of rapid responses to the journal, I'm extremely skeptical that ethnicity estimations based on names are valid. In my view, large amounts of potential misclassifications make the data unreliable, and therefore, unfortunately, conclusions based on the data are also unreliable, even though the topic itself is worthy of study and the conclusions themselves may actually be correct.

Nameprism is specifically trained and tuned to achieve the best performance on a global dataset, which makes it very well suited to the global nature of readers and authors in the BMJ. This global external validation is why we believe the state-of-the-art performance of nameprism is representative of the performance it will achieve on BMJ author names.

Additionally, it is unlikely that this study is more problematic than studies using existing classifications such as self-reported measures in the Office of National Statistics. These are limited by ambiguous categories such as "other", as well as discrepancies between the self-reported measure and the person's perceived ethnicity.

Regardless, the BMJ's House Style recommends accurate descriptions of how ethnicity has been defined, and we have added further information in the methods section to clarify this.

6. I can't see any way of appeasing the concerns raised without checking a randomly selected subset of the authors and confirming with the author their gender and ethnicity, as one of the Reviewers already suggested. It might or might not be laborious depending on what information the authors extracted from the BMJ website. Email addresses will be available from the published letters to the editor, either on the BMJ, or through Pubmed or some other database, so it should be a relatively straightforward exercise to automatically extract the emails and then contact the authors asking them whether the programs had estimated their gender and ethnicity correct. This will be a time-consuming process and might require ethical review, but is the only way I can see to ensure the data are actually valid.

The nameprism.com tool has already been trained and validated on multiple datasets, representative of the global population, with a sample size approximately three orders of magnitude greater than our entire dataset of rapid responses. Therefore we don't believe any further validation that we can do is necessary or beneficial.

However, we acknowledge that gender guesser had limited validation, and so we have referenced an existing validation study, as well as performing our own larger validation summarised above.

Reviewer: 4

The authors have presented an extensive and well-written analysis of the influence of the gender and ethnicity on publication of the rapid responses in the BMJ. The methodology robust and well-explained. I have the following suggestions for improvement:

Thank you for describing our work as "extensive and well-written", and the methodology as "robust and well explained". We are happy to read and consider your suggestions.

I wouldn't appreciate the use of the term "black" for an ethnic group. In my humble opinion, this is a racially offensive term and should not be used, please consider using "African-American" instead. Please change this throughout the manuscript

Thank you for the suggestion, and we apologise for any offence caused. However, we have to agree with the BMJ editorial team that "black" is the correct term to use here. This is for several reasons, including:

- It is the most accurate word in this context. For example, a black person born in the Caribbean and submitting to the BMJ after moving to England might not consider themselves African nor American.
- "Black" is the word used in nameprism.com, so changing this word implies that we are changing the categorisation, which we are not.
- The word is used widely in the literature, as well as official ethnic categories, including in the US and UK.
- It is a generally accepted word in public discourse, for example in the "Black Lives Matter" movement, and "Black History Month".

Please mention the number of the responses (<2%) that could not be collected automatically due to errors in their formatting.

Thank you for the suggestion. We analysed these responses and included this in the final paper. There were 528 responses that could not be collected automatically (0.46%).

What is the validity of the textstat and language-check tool?

The python modules textstat and language-check use natural language processing and basic calculations to generate their outputs with no machine learning modules used. For example, the "flesh-reading-ease" variable, extracted by textstat, is a calculation based on the number of words and syllables in the sentence. Flesh reading ease was developed in 1975 and is one of the most commonly used formulas for calculating readability. The language-check tool works in the same way as spell check in Microsoft Word, checking spelling against a dictionary, and using a library of grammatical rules to identify errors.

Name-prism also gives information about the nationality of the author, why was not this considered?

During our preliminary analysis we looked at nationality as a variable. We opted not to use nationality for several reasons:

- We found this data very arbitrary, the authors of the nameprism paper themselves saying "there is no 'gold standard' name-based nationality taxonomy because of the complexity in naming customs around the world".
- For example, some "nationality" categories are not even nationalities, such as "Jewish".
- There were 39 possible nationalities which meant many nationalities had very few authors associated with them. This limited the ability to predict publication patterns using such small sample sizes.
- Nationality and ethnicity, although distinct, are related identities, and so using ethnicity captures some of the same information as nationality.
- We found the nationality categories were unbalanced in the area they covered, for example, "West African" covers 8 countries, whilst there is a separate nationality for "Greek".

It would better not to start a sentence with a digit. Please check and correct on line # 49 of page # 7

Thank you, we have amended the wording.

The abbreviations should be spelled out at the bottom of the table. Any additional notes should also be placed at the bottom of the table.

The findings of the univariate analysis should appear in the table as well.

We have spelled out the abbreviations in the table legends. We have added the results of the univariate analysis to table 1.

I wonder why authors have not included findings of both the blocks in the table. I would appreciate if this is done.

We have done this as suggested.

Twitter account was taken as a variable. Twitter was founded in 2006, so authors publishing rapid responses after this time might have been included.

All rapid responses within the study period were included, some of these prior to 2006. The data was treated in the same way, so if an author provided no Twitter handle then "Twitter handle provided" was false regardless of year.

Page 10 line 43: "in the UK" should be changed to "outside the US" as the reference made should not be limited to 2.

Thank you, we have amended this.

Page 10 line 52: "true data" or "truth data"?

This is correct, we are talking about "ground truth" data, i.e. data which is not inferred.

The discussion needs some re-structuring. The strengths and limitations should come at the end of it. This section should rather begin with "Meaning of the study".

Conclusion section should be added at the end.

Thank you, we have added a conclusion section as you suggest. However, we have kept "strengths and limitations" early in the discussion, because we believe this is very important context for the rest of the discussion. I.e., it is important to know the strengths and limitations before discussing implications or future work.

References should be according to the journal's style.

BMJ Open doesn't specify a preferred reference style in the guidance for authors (<https://bmjopen.bmj.com/pages/authors/>), so we have used the Vancouver style in accordance with the BMJ house style (<https://www.bmj.com/about-bmj/resources-authors/house-style>). If this is incorrect, we will change it to the appropriate style.

VERSION 2 – REVIEW

REVIEWER	Karin Amrein Medical University Graz, Austria
REVIEW RETURNED	14-Aug-2020

GENERAL COMMENTS	The authors have well and in detail addressed previous reviewer suggestions.
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REVIEWER	Gabrielle Ramirez University of Pennsylvania, United States of America
REVIEW RETURNED	19-Aug-2020

GENERAL COMMENTS	<p>I would like to thank the authors for considering my past suggestions. I believe this version is ready for publication.</p> <p>The authors suggest that ethnic and gender gaps continue to exist in journals. They provided both relevant background information and new correlational data to support their case. As previously suggested, the authors also validated the electronic tools used to collect the data. Given that names may not always be predictive of gender or ethnicity, I appreciate the authors taking the additional time to validate these tools and appease skeptics' concerns. In general, the matching protocol is thorough enough for others to reproduce similar results.</p> <p>The paper is also better formatted. I like that the authors consolidated the baseline and univariate analysis tables, as recommended. The discussion of the paper humbly acknowledges the limitations of the study. I am content that the researchers noted the potential of machine learning in future projects and examples of unanswered questions.</p> <p>My only suggestion before publication is to standardize the language of the paper. Before Table 1, the authors use "inferred gender or ethnicity." I feel that this is more appropriate than using "gender or ethnicity" because it acknowledges that the value (or label) is an assumption and not a known fact.</p> <p>Overall, I commend the authors for taking this grand feat and bringing to light a very relevant issue in today's world. After reading this paper, I expect that editors, writers, and readers will feel inspired to reflect on their own biases. With time, others may apply the authors' methods to continue researching this topic.</p>
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